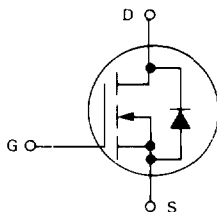


MOTOROLA SEMICONDUCTOR TECHNICAL DATA

N-CHANNEL ENHANCEMENT-MODE SILICON GATE TMOS POWER FIELD EFFECT TRANSISTOR

These TMOS Power FETs are designed for low voltage, high speed power switching applications such as switching regulators, converters, solenoid and relay drivers.

- Silicon Gate for Fast Switching Speeds
- Rugged — SOA is Power Dissipation Limited
- Source-to-Drain Diode Characterized for Use With Inductive Loads



MAXIMUM RATINGS

Rating	Symbol	IRF				Unit
		510	511	512	513	
Drain-Source Voltage	V_{DS}	100	60	100	60	Vdc
Drain-Gate Voltage ($R_{GS} = 1.0 \text{ M}\Omega$)	V_{DGR}	100	60	100	60	Vdc
Gate-Source Voltage	V_{GS}	= 20				Vdc
Continuous Drain Current $T_C = 25^\circ\text{C}$	I_D	4.0	4.0	3.5	3.5	Adc
Continuous Drain Current $T_C = 100^\circ\text{C}$	I_D	2.5	2.5	2.0	2.0	Adc
Drain Current Pulsed	I_{DM}	16	16	14	14	Adc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	20 0.16				Watts W/°C
Operating and Storage Temperature Range	T_J, T_{stg}	-55 to 150				°C

THERMAL CHARACTERISTICS

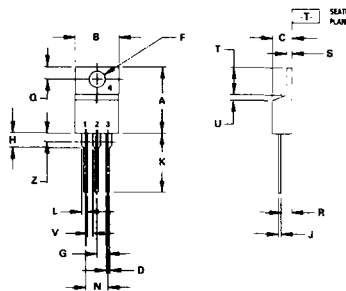
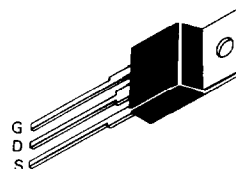
Thermal Resistance Junction to Case	$R_{\theta JC}$	6.4	°C/W
Junction to Ambient	$R_{\theta JA}$	62.5	
Maximum Lead Temp. for Soldering Purposes, 1/8" from case for 5 seconds	T_L	300	°C

See the MTP6N10 Designer's Data Sheet for a complete set of design curves for this product.

IRF510 IRF511 IRF512 IRF513

Part Number	V_{DS}	$r_{DS(on)}$	I_D
IRF510	100 V	0.6 Ω	4.0 A
IRF511	60 V	0.6 Ω	4.0 A
IRF512	100 V	0.8 Ω	3.5 A
IRF513	60 V	0.8 Ω	3.5 A

IRF510
IRF511
IRF512
IRF513



NOTES

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982
2. CONTROLLING DIMENSION: INCH
3. DIM Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED

STYLE 5

1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	14.48	15.75	0.573	0.622
B	9.56	10.28	0.380	0.409
C	4.07	4.62	0.160	0.186
D	0.64	0.98	0.025	0.039
E	3.61	3.73	0.142	0.147
F	2.42	2.56	0.095	0.101
G	2.80	3.03	0.110	0.120
H	0.38	0.55	0.014	0.021
K	12.70	14.27	0.500	0.561
L	1.15	1.39	0.045	0.055
N	4.83	5.33	0.190	0.211
Q	2.54	3.04	0.100	0.120
R	2.04	2.79	0.080	0.110
S	1.15	1.39	0.045	0.055
T	5.97	6.47	0.235	0.255
U	0.38	1.27	0.014	0.050
V	1.15	—	0.045	—
Z	—	2.04	—	0.080

CASE 221A-04
TO-220AB

IRF510-513

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain-Source Breakdown Voltage (V _{GS} = 0, I _D = 250 μA) IRF510,512 IRF511,513	V _{(BR)DSS}	100 60	—	—	V _{dc}
Zero Gate Voltage Drain Current (V _{GS} = 0 V, V _{DS} = Rated V _{DSS}) (V _{GS} = 0 V, V _{DS} = 0.8 Rated V _{DSS} , T _C = 125°C)	I _{DSS}	— —	— —	0.25 1.0	mAdc
Forward Gate-Body Leakage Current (V _{GS} = 20 V, V _{DS} = 0)	I _{GSSF}	—	—	100	nAdc
Reverse Gate-Body Leakage Current (V _{GS} = -20 V, V _{DS} = 0)	I _{GSSR}	—	—	-100	nAdc

ON CHARACTERISTICS*

Gate Threshold Voltage (V _{DS} = V _{GS} , I _D = 250 μA)	V _{GS(th)}	2.0	—	4.0	V _{dc}
On-State Drain Current (V _{DS} = 25 V, V _{GS} = 10 V) IRF510,511 IRF512,513	I _{D(on)}	4.0 3.5	— —	— —	Adc
Static Drain-Source On-Resistance (V _{GS} = 10 V, I _D = 2.0 A) IRF510,511 IRF512,513	r _{DS(on)}	— —	— —	0.6 0.8	Ohms
Forward Transconductance (V _{DS} = 15 V, I _D = 2.0 A)	g _{FS}	1.0	—	—	mhos

DYNAMIC CHARACTERISTICS

Input Capacitance	(V _{DS} = 25 V, V _{GS} = 0, f = 1.0 MHz)	C _{iss}	—	—	150	pF
Output Capacitance		C _{oss}	—	—	100	
Reverse Transfer Capacitance		C _{rss}	—	—	25	

SWITCHING CHARACTERISTICS* (T_J = 100°C)

Turn-On Delay Time	V _{DD} = 0.5 V _{DSS} , I _D = 2.0 A Z _o = 50 Ω	t _{d(on)}	—	—	20	ns
Rise Time		t _r	—	—	25	
Turn-Off Delay Time		t _{d(off)}	—	—	25	
Fall Time		t _f	—	—	20	

SOURCE DRAIN DIODE CHARACTERISTICS*

Characteristic	Symbol	Typ	Unit
Forward On-Voltage	V _{SD}	2.0	V _{dc}
Forward Turn-On Time	t _{on}	Limited by stray inductance	
Reverse Recovery Time	t _{rr}	230	ns

INTERNAL PACKAGE INDUCTANCE (TO-220)

	Symbol	Min	Typ	Max	Unit
Internal Drain Inductance (Measured from the contact screw on tab to center of die) (Measured from the drain lead 0.25" from package to center of die)	L _d	—	3.5 4.5	—	nH
Internal Source Inductance (Measured from the source lead 0.25" from package to source bond pad.)	L _s	—	7.5	—	

*Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0 %.

RESISTIVE SWITCHING

FIGURE 1 — SWITCHING TEST CIRCUIT

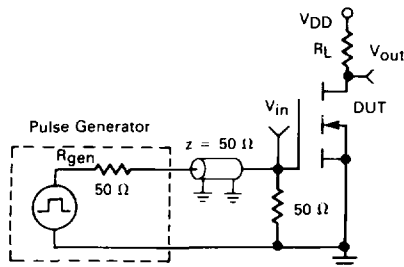


FIGURE 2 — SWITCHING WAVEFORMS

